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SIMS RESULTS FOR SOLAR WIND ELEMENTAL ABUNDANCES FROM GENESIS COLLECTORS

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Introduction: Solar wind elemental abundances are a major Genesis science objective. Spacecraft studies have shown that elements with first ionization potential (FIP) > 9 eV are fractionated relative to those with lower FIP compared with the solar photosphere; however, among elements with FIP < 9eV (which make up most of the terrestrial planets) there is no evidence of fractionation. A major goal of Genesis is to provide a higher precision test of the lack of fractionation for FIP < 9eV.

Method and Results: Accordingly, bulk solar wind analyses for several elements on a variety of Genesis solar-wind collector types are being made by SIMS using the ASU 6f and UCLA 1270 instruments. Fluences are calculated relative to implant standards; relative sensitivity factors (RSFs) are calculated for each set of analyses.

Figure 1 plots Fe and Mg measured in two collector types versus ACE data [1]. Results for some elemental fluences, such as Fe, appear to be consistent across different collector types and techniques. Conversely, results for Mg differ based on collector type even though the solar-wind analytical profiles are clear and multiple standards were made (implanted) simultaneously.

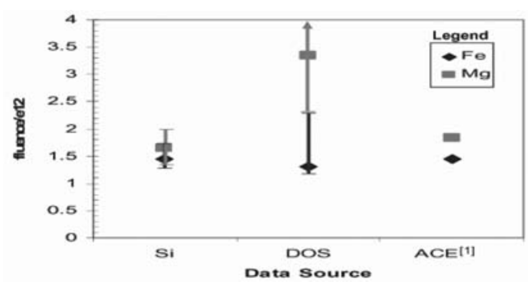

Fig. 1. Average (symbol) and full range (bars) of Genesis solar wind data compared with ACE-derived fluences [1].

We currently have measured fluences for Fe, Mg, Ca, Cr, and Na, but are still investigating possible systematic analytical errors; accordingly, there are no error bars in Fig. 2 below. New standards are currently being generated to see if flight-induced changes (i.e., H-retention; radiation damage) affect the RSFs for the SIMS analyses. In any case, our data show a reasonably close correspondence with photospheric values at this point.

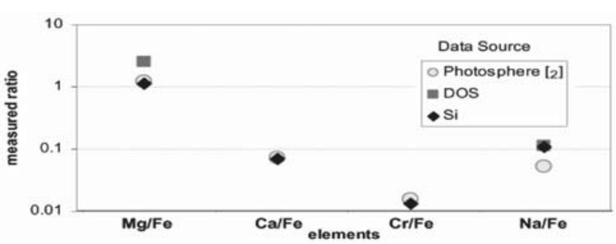

Fig. 2. Comparison of Genesis preliminary measurements from photospheric measurements from [2].

References: [1] Reisenfeld D. et al. ISSI Symposium on the Composition of Matter. Forthcoming. [2] Asplund M. et al. 2004. In *Cosmic abundances as records of stellar evolution and nucleosynthesis,* edited by Bash F. N. and Barnes T. G.

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COMPLEX CRATERS ON STARDUST ALUMINUM FOILS: EXPERIMENTAL SIMULATION OF COMET DUST IMPACT BY POROUS AGGREGATE PARTICLES

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Introduction: Impact of Wild-2 cometary dust on the aluminum (Al) foils of the Stardust spacecraft created numerous distinctive features [1]. Many are “bowl-shaped” depressions similar to experimental craters from our previous light gas gun shots of mineral grains [2]. However, complex morphology is also common in Stardust impacts, suggesting inhomogeneous internal distribution of mass within impactors [3], like fractal dust aggregates [4, 5]. Our aim has been to recreate complex impact features by shots of novel projectile types, to understand impactor properties that control crater shape, and thence improve interpretation of Wild-2 dust in terms of grain mass and internal structure, especially porosity and density.

Experimental and Analytical Techniques: Buckshot firings onto Al alloy targets were performed at the University of Kent. Porous aggregate projectiles were created by two different methods: 1) from a polydispersive mixture of powdered olivine, Mg orthopyroxene, Ca clinopyroxene, Cr spinel and pyrrhotite, bound by aerosol adhesive droplets; 2) sintered aggregates of 1.5 μm monodispersive silica microspheres [6]. Aggregate particles and impact features were examined by analytical scanning electron microscopy. Stereo-pair images were combined into three dimensional shape models using the Alicona MeX program [7].

Results and Discussion: The shots yielded hundreds of craters. “Bowl-shaped” features of a wide size range were abundant, suggesting impacts by single, dense mineral grains, and implying that many aggregates broke during acceleration and flight. However, large numbers of features were shallow with noncircular outline shape and complex internal structure, many resembling Stardust impacts, albeit of larger size. The mutual interference of depressions in these craters, and in some cases patches of diverse residue composition derived from distinct mineral subgrains, shows clear evidence of synchronous impact by an aggregate, rather than fortuitous crater overlap from discrete particles. The shape is distinct from craters formed by single mineral grains of elongate shape (e.g., acicular needles).

We are now developing mineral aggregates of finer, better-constrained, subgrain sizes, and shall investigate impact of aggregate projectile types on silica aerogel, as well as Al foil.

References: [1] Hörz F. et al. 2006. *Science* 314:1716–1719. [2] Kearsley A. T. et al. 2006. *Meteoritics & Planetary Science* 41:167–180 [3] Kearsley A. T. et al. *Meteoritics & Planetary Science*. Forthcoming. [4] Greenberg J. M. and Gustafson B. Å. S. 1981. *Astronomy & Astrophysics* 93:35–42. [5] Blum J. and Wurm G. 2000. *Icarus* 143.1:138–146. [6] Poppe T. 2003. *Icarus* 164:139–148. [7] Kearsley A. T. et al. 2007. *Meteoritics & Planetary Science* 42:191–210.